The effect of corporate bond purchases by the ECB on firms' borrowing costs

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Abstract
One of the measures included in the quantitative easing policy adopted by the ECB was the purchase of corporate bonds. In this article, we analyze the announcement effects of the corporate sector purchase programme (CSPP). Only bonds that meet a set of criteria can be purchased by the Eurosystem. Using a difference-in-differences estimation, we compare the evolution of bond prices for eligible versus non-eligible corporate bonds. We confirm previous results for the euro area, showing that the decrease of the yields on non-eligible bonds was larger than on eligible ones. These results show that there were indirect effects stemming from the CSPP, which are consistent with a portfolio rebalancing mechanism. For the case of Portugal, the announcement had a more positive effect on CSPP-eligible securities. Despite the lower financing costs, eligible issuers in Portugal did not significantly change their issuance behavior. (JEL: E52, E58, G30)

1. Introduction

Throughout the decade that followed the collapse of Lehman Brothers, the European Central Bank (ECB) implemented a wide range of unconventional monetary policy measures to achieve its objectives. Quantitative easing measures were among the most prominent. By purchasing financial assets in the markets, central banks are able to promote price stability through mechanisms that do not rely only on the traditional transmission of monetary policy through banks. The purchase of sovereign bonds was possibly the most noteworthy (through the public sector purchase programme - PSPP), but the Eurosystem also purchased other financial assets, such as covered bonds (CBPP) or asset-backed securities (ABSPP).

In this article, we examine the announcement effects of one quantitative easing programme: the corporate sector purchase programme (CSPP). The CSPP – also known as the corporate Quantitative Easing (QE) – was designed to allow the ECB to lend money to corporations. The corporate QE, announced in March 2016, was a vehicle

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for the ECB to inject funds directly in the real economy through the purchase of non-financial corporate bonds. According to the Governing Council, the programme was designed to "provide further monetary policy accommodation and contribute to a return of inflation rates to levels below, but close to, 2% in the medium term".

Only bonds that meet a set of specific criteria defined by the ECB are eligible for the programme. This allows us to compare the evolution of corporate bond yields after the announcement of the programme for eligible and non-eligible issues. The programme might have had two simultaneous effects on bond yields. The *direct effect* is an expected decrease of the bond yields of the eligible securities (i.e., an increase in its price). Increased demand and enhanced liquidity both should contribute to this effect. But the programme might also have had an *indirect effect*. The yields of bonds that are not eligible might also have decreased. Given the relative small scale and lack of liquidity of the European corporate bond market, investors might have increased their demand for non-eligible bonds. This portfolio rebalancing behaviour may be reinforced due to the prevailing low interest rates and risk premia.

To understand if these two effects were present and which of the two dominates, we collect data on European bonds for the period comprised between January 2016 and September 2017. This allows us to focus on the immediate effects of the announcement of the CSPP, but also to examine the behavior of bond yields for eligible and non-eligible issues in a longer horizon. We follow an approach that is similar to recent papers on the same topic (Grosse-Rueschkamp, Steffen and Streitz, 2019, Arce, Gimeno and Mayordomo, 2017, and Abidi and Miquel-Flores, 2017), applying it also to the Portuguese corporate bond market.

The analysis is anchored on the comparison of bond yields for bonds that meet the eligibility criteria defined by the ECB (treatment group) and those that do not (control group). One important caveat of this comparison might be that bonds in the control group are very different from the eligible ones. To address this, we consider an alternative control group, where we include only bonds that meet all the criteria defined by the ECB with the exception of the credit rating.

We find that bond yields generally decreased after the announcement of the CSPP, in March 2016. Once the Eurosystem actually started purchasing the bonds, in June, yields showed a further decrease. When we compare the evolution of eligible and non-eligible bonds, we find that this decrease was more pronounced for the non-eligible bonds. This result holds for both definitions of the control group. The indirect effects of the programme thus seem to have been larger than the direct ones. This result can be explained by the portfolio rebalancing of investors. The accommodative monetary policy stance possibly encouraged investors to rebalance their portfolio asset allocation, in order to recapture the portfolio's original risk and return characteristics. To achieve that, investors need to purchase more risky assets (such as non-eligible CSPP securities). In this search for yield environment, investors try to compensate the lower returns they have on safer assets (which now include eligible CSPP securities) through risk-increasing portfolio shifts or through greater risk-taking on new investments.

When we run the same exercise for Portuguese corporate bonds, the results are substantially different. In this case, we find that the direct effect dominates. The decrease

of bond yields is steeper for the eligible bonds. Given the small size of the Portuguese corporate market, one possible explanation is that investors' portfolio rebalancing decisions are most likely not done within the portfolio of Portuguese corporate bonds, but within a larger pool of financial assets.

The remainder of study proceeds as follows. Section 2 describes the main features of the CSPP. In Section 3 we discuss the existing evidence on the literature on the corporate sector asset purchase programme. In Section 4 we proceed by describing the empirical strategy and the data used in the analysis. In Section 5 we present the results of our analysis for the euro area and, in Section 6, for Portugal. Section 7 summarizes our main findings.

2. The CSPP and the euro area corporate debt market

In the years following the failure of Lehman Brothers, central banks around the world adopted an unprecedented set of unconventional monetary policy measures to pursue their mandates. One of the measures adopted was the direct purchase of assets by the central banks, through quantitative easing programmes.

The Eurosystem started to purchase assets in specific categories during the euro area sovereign debt crisis, through the asset purchase programme (APP).[1] These included covered bonds (CBPP - covered bonds purchase programme) and asset-backed securities (ABSPP - asset-backed securities purchase programme). In March 2015 the Eurosystem started to buy euro-denominated investment-grade bonds issued by euro area governments, though only in secondary markets (PSPP - public sector purchase programme).

One year later, the ECB added another programme. In order to strengthen the transmission of monetary policy and the financing conditions of the real economy, on March 2016 the ECB announced the corporate sector purchase programme (CSPP).[2] This programme enables outright purchases of euro-denominated investment-grade bonds, in both primary and secondary markets, issued by euro area non-financial corporations. At the same time, the monthly purchases of EAPP were increased to 80 billion euros and a new set of targeted longer-term refinancing operations (TLTRO II) were announced.[3]

The bonds eligible for ECB purchases have to meet well-defined criteria:

1. For further details please see $https://www.ecb.europa.eu/mopo/implement/omt/html/index.en.html$.

2. The press release of this announcement may be found here $https://www.ecb.europa.eu/press/pr/date/2016/html/pr160310_2.en.html$

3. While these two announcements had significant effects on financial markets and, consequently, on corporate debt markets, they could only affect our results if eligible and non-eligible issuers are differentially affected by the EAPP or by the TLTRO II announcement. For the purchase of sovereign bonds, this hypothesis can be easily dismissed. In what concerns the TLTRO II, Arce, Gimeno and Mayordomo (2017) show that banks decrease lending to eligible firms, allowing them to lend more to non-eligible firms. However, these effects can only be assessed ex-post and should not have affected the relative evolution of bond yields of these two groups of firms immediately after the announcement.

- Eligible securities must be acceptable as collateral for monetary policy credit operations;
- Assets must be denominated in euros and purchases must be conducted at a yield-to-maturity (or yield-to-worst) above the deposit facility rate;[4]
- The location of incorporation of the issuer must be in the euro area. The issuer's ultimate parent location is not taken into consideration;
- The issuer or its parent company may not be a credit institution neither a public-undertaking;
- Bonds must have a minimum remaining maturity of 6 months and a maximum of 30 years and 364 days at the time of purchase;
- The issue must have a minimum credit rating assessment of BBB- or equivalent, provided by at least one of the four ECB recognized agencies, namely Fitch, Moody's Standard & Poor's and DBRS;
- There is no minimum issuance volume.[5]

The Eurosystem started to effectively purchase corporate securities on June 8, 2016. In order to help reduce market distortions and bond scarcity, from July 2016 onward all the bonds acquired by the Eurosystem were made available for securities lending purposes, thus contributing to an increase in market liquidity. From the inception of the programme until September 2017, the Eurosystem was holding 114,658 million of euros of the available universe of securities, 15% of which acquired in primary market purchases. By September 2017, the holdings of corporate debt securities under this programme represented 5% of all the assets purchased by the ECB under the APP.

The CSPP was designed to achieve the ECB's price stability goal. The transmission of monetary policy in the euro area was to some extent impaired during the euro area sovereign debt crisis and the purchase of corporate debt was a step towards ameliorating the workings of the transmission mechanisms. However, the programme might have played a broader role in shaping the financial system in the euro area. Banks play a much larger role than markets in the euro area. This is especially true when a comparison is made with the UK and, especially, with the US (Langfield and Pagano, 2016). The bank-biased structure is associated with greater systemic risk and worse growth performance and, although bank loans and bond financing are not perfect substitutes (Becker and Ivashina, 2014), the shift towards market funding could help reduce systemic consequences during times of crises. There is evidence that economic activity is more sensitive to asset price movements in bank-based systems than in market-based ones (Brunnermeier and Sannikov, 2012, Boissay, Colliard and Smets, 2016).

The CSPP, together with other initiatives at the European level (such as the Capital Markets Union), might have contributed to an increase in corporate bond financing in the euro area. The amount of net issues of corporate bonds in the euro area almost doubled between 2015 and 2017 (Figure 1). The countries where this increase was more

4. From September 2019 onward the deposit facility restriction does not apply;

5. These criteria can be found here: $https://eur-lex.europa.eu/eli/dec/2016/948/oj/eng$.

pronounced were at the core of the euro area sovereign debt crisis (Cyprus, Ireland, Greece and Spain). In Portugal, net issuances increased only slightly since the beginning of the CSPP.

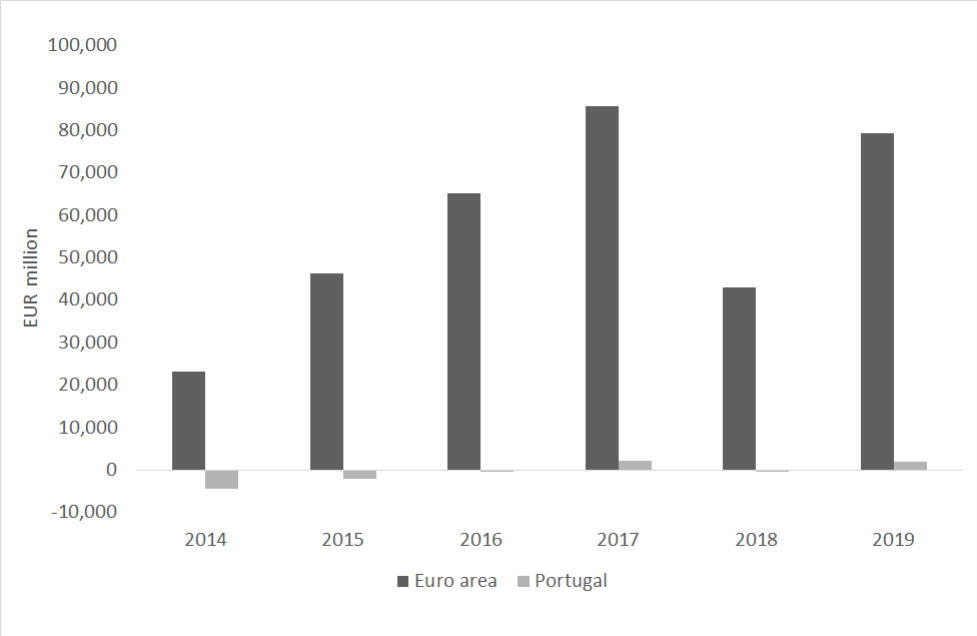

FIGURE 1: Net issues of corporate bonds
Source: ECB.

After the announcement of the CSPP, the increase in bond issuance documented in Figure 1 was accompanied by a significant decrease in bond yields. Figure 2 depicts the asset swap spread for the iBoxx Euro Non-Financials indices for several rating categories. The announcement of the CSPP on March 10, 2016 lead to a sizeable decrease in asset swap spreads.

The decrease was significant in all rating categories, suggesting that not only eligible bonds were affected. The spread between AAA and BBB indices tightened about 20 basis points (bps), from over 100 bps at the announcement date, to 80 bps at the effective starting date of CSPP (June 8, 2016). From this date onward, the spread tightened another 20 bps, to roughly 60 bps. The announcement effect on A-rated securities was not as impactful, as the spread between AAA and A-rated securities only decreased about 10 bps from the announcement date onward.

3. Related literature

The descriptive evidence presented above suggests that the CSPP might have been associated with more corporate bond issuance, at lower costs. These effects have been studied in depth in several recent papers. Grosse-Rueschkamp, Steffen and Streitz (2019) compare the eligible and non-eligible issuers and find that eligible firms move from loan to bond financing, reflecting the lower financing costs. Arce, Gimeno and

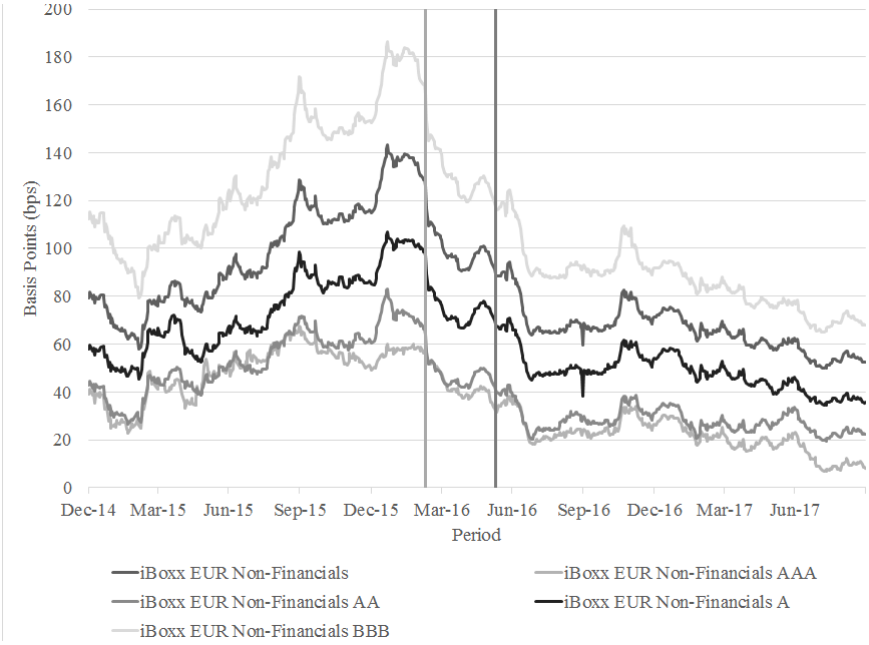

FIGURE 2: Asset swap spreads for euro area firms

Note: The figure shows the asset swap spread for the iBoxx indices. For each index, the asset swap spread is the weighted average of the asset swap spread of all constitutent bonds in the specific index. The asset swap spread of a bond is the difference between the yield of a bond and the Markit iBoxx swap curve. The two vertical lines represent the announcement date and the effective starting date of the programme.
Source: Refinitv.

Mayordomo (2017) analyze the combined effect of CSPP and Targeted Longer-Term Refinancing Operations (TLTROs) on Spanish non-financial firms and document a sizeable reallocation of credit towards smaller firms. They also find evidence that the CSPP announcement increased bond issuance by eligible firms. Abidi and Miquel-Flores (2017) find evidence of improved financial conditions for firms around the market eligibility thresholds. They consider that there might be a divergence between what is eligible for the ECB and market participants' risk assessment, especially around the investment grade threshold. Exploring this risk management divergence, they document a deterioration in CSPP-eligible bonds liquidity and, more importantly, larger drop in yields of non-eligible firms (which is consistent with the results we obtain in our analysis).

The effects of the CSPP may go beyond these direct and expected effects. One important issue to consider is that the CSPP might have lead to a liquidity squeeze in credit markets, due to bond scarcity. Even though the ECB tries to alleviate these concerns through securities lending, it cannot be ruled out that investors had incentives to shift to other (riskier) asset classes, in particular non-eligible non-financial corporate bonds (Vayanos and Villa, 2009; Hancock and Passmore, 2011; Arrata and Nguyen, 2017).

Another effect is that this scarcity possibly encouraged companies to issue more bonds, even if they are not eligible for the programme (Abidi and Miquel-Flores, 2017). This should contribute to an increase in liquidity in both primary and secondary

markets, with potential positive spillovers on firms' growth and performance through better financing conditions. Abidi and Miquel-Flores (2017) find that bond issuance is stronger for firms whose rating is close to the investment grade/non-investment grade frontier.

Finally, the CSPP might have improved access to bank loans. Given that the programme induces a shift from loan to bond financing by eligible firms, banks may redirect the funds that become available to other firms (Grosse-Rueschkamp, Steffen and Streitz, 2019). This means that small and medium enterprises (SMEs) and firms without access to the bond market might also have benefited indirectly from the CSPP (Arce, Gimeno and Mayordomo, 2017).

4. Empirical methodology and data

4.1. Methodology

To analyze the announcement effects of the CSPP, at the euro area level and in Portugal, we will compare the evolution of bond yields for eligible and non-eligible bonds after the announcement date. The eligible securities are defined as those that meet all the criteria outlined in Section 2. In general terms, all euro area bonds issued by non-financial corporations in euros that are accepted as collateral by the ECB, have a residual maturity of at least 6 months and have a rating of at least BBB- will belong to the treatment group.

The price reaction of these bonds will be compared with other euro area securities that do not meet the necessary criteria. The securities were selected from the universe of non-financial euro area securities available in Bloomberg, with a maturity date equal to or later than January 1, 2016.

We consider two control groups. The first one includes all the securities with price information downloaded from Bloomberg that do not meet at least one of the criteria defined by the ECB (control group 1). However, this broad control group includes bonds that may be too far from the eligibility threshold, undermining the comparability of the two groups. To mitigate these concerns, we consider a more restricted control group, where we include only bonds that fulfill all the criteria specified by the ECB with the exception of the rating (control group 2).

We estimate a difference-in-differences regression to capture the CSPP announcement effect on the yields of eligible bonds ($Eligible_{it}$), compared to those in the control group, after the announcement date ($Post_t$), such that:

$$Yield_{it} = \alpha_1 Eligible_{it} * Post_t + \alpha_2 Eligible_{it} + \alpha_3 Post_t + \beta X_{it} + \gamma j \quad (1)$$

$Eligible_{it}$ takes the value one for each bond i in the treatment group and $Post_t$ takes the value one from March 10, 2016 onward (and zero otherwise). We are interested in the coefficient α_1, which captures the differential behavior of eligible bonds after the announcement of the programme. X_{it} includes time-varying bond characteristics such as rating or tenor. We consider ratings as numerical values. We consider the best credit

rating awarded to a given security i by the four agencies approved by the ECB (S&P, Moody's, Fitch and DBRS) at time t. Tenor is defined as the days-to-maturity of security i at day t. Finally, γj refers to country fixed effects, that allow to control for time-invariant characteristics of the jurisdiction of the issuer.

4.2. Data and descriptive statistics

The data used in the analysis correspond to all non-financial European securities available in Bloomberg, with a maturity date equal to or later than January 1st, 2016. A total of 6,061 ISINs were extracted. The yields of the securities in the analysis were collected on a daily basis for a time frame between January 2016 and September 2017.

The yield-to-worst[6] and yield-to-maturity were both retrieved from Bloomberg and Refinitv databases. The sample was initially built with Bloomberg data, starting with the yield-to-worst. A few bonds bear some kind of optionality and the yield-to-maturity ignores these options and assumes that they will not be exercised. We prefer to use the yield-to-worst over the yield-to-maturity as it assumes the worst case scenario assumptions. Whenever yield-to-worst was missing, the yield-to-maturity for that bond was used. If there were any securities without any Bloomberg data for all sample days, Refinitv data was used also, giving preference to yield-to-worst over yield-to-maturity. Other bond characteristics such as credit rating, issuer, country of incorporation, maturity were retrieved from Bloomberg. Tenor was computed using the maturity date of each bond.

The dataset was created at the bond level rather than at the firm level, following the approach adopted by Abidi and Miquel-Flores (2017). We consider that the analysis at the bond level may deliver more accurate results on the announcement effects. Indeed, the eligibility criteria are defined at the bond rather than at the issuer level. For instance, firms without a rating may issue bonds that can still be eligible for the programme. [7] While previous papers have focused on firm eligibility to examine firm-level outcomes (Grosse-Rueschkamp, Steffen and Streitz, 2019, Arce, Gimeno and Mayordomo 2017), our focus on announcement effects on bond yields makes this bond-level analysis even more relevant.

For each ISIN we collected the credit rating assigned on each day by all the four agencies that the ECB considers eligible for criteria purposes (S&P, Moody's, Fitch and DBRS). On this issue we also depart from previous studies, which have relied on rating information only from one of the agencies. The only exception that we are aware of that considers the four rating agencies for all euro area bonds is again Abidi and Miquel-Flores (2017). Given that we collect daily ratings, we can define eligibility on a daily basis. A numerical scale was applied to ratings, ranging from 0 (not rated or missing) to 22 (AAA/Aaa). With these four rating vectors per ISIN for each day, a single rating

6. The yield-to-worst is defined as the lowest possible yield that can be received on a bond that does not default. This yield considers options associated to the bond, such as callability.

7. A firm that is not rated could still have bonds eligible for the programme if the bond is rated as investment grade or the issue is guaranteed by an eligible guarantor.

variable was created with the highest rating assigned on each day, as the ECB only requires that at least one agency-rating is investment grade.

To have a coherent sample, all securities that were registered outside the euro area were eliminated. All perpetual and convertible bonds were dropped from the sample, since the ECB does not accept these securities in the CSPP programme. From the initial 6,061 bonds, there are 4,765 left. This compares with 814 bonds used in Grosse-Rueschkamp, Steffen and Streitz (2019) and with 1,310 in Abidi and Miquel-Flores (2017).

To make sure that the results are not influenced by bonds with extreme prices, we winsorized bond yields. We considered that corporate bonds yields could not be lower than the historical minimum for German 10 year bonds (-0.86%) and we truncated the maximum at the 95th percentile.

Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	2.06	1.13	2.54	-0.86	16.57	1,203,095
Tenor	2,070	1,571	2,507	0	34,769	1,203,095
Credit Rating	B+/B1	BB+/Ba1	B-/B3	Not rated	AAA/Aaa	1,203,095

TABLE 1. Descriptive statistics of the full dataset

Note: This table reports the descriptive statistics for the key variables of the entire dataset for the period between January 2016 and September 2017. Tenor is reported in days.

Table 1 shows the descriptive statistics for the complete dataset. After the winsorization process described above, the average yield for corporate bonds is 2.06%. On average, bonds have a residual maturity of 5.7 years. The securities for which we collected information have, on average, a credit rating of B+/B1, which means that most of the rated bonds are below the investment grade threshold.

Eligible bonds						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	0.82	0.54	1.02	-0.40	15.04	547,700
Tenor	2,281	1,907	1,762	183	10,956	547,700
Credit rating	A-/A3	BBB+/Baa1	1.97	BBB-/Baa3	AAA/Aaa	547,700
Cum. yield change	-0.43	-0.50	0.23	-0.69	0.27	547,700

Control group 1 (all non-eligible bonds)						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	3.09	2.33	2.93	-0.86	16.57	655,395
Tenor	1,893	1,360	2,896	0	34,769	655,395
Credit rating	CCC-/Caa3	Not rated	5.40	Not rated	AAA/Aaa	655,395
Cum. yield change	-0.75	-0.79	0.42	-1.38	0.52	655,395

Control group 2 (bonds that meet all criteria except rating)						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	3.34	2.63	2.90	-0.40	16.57	566,707
Tenor	1,747	1,492	1,305	183	10,934	566,707
Credit rating	CC/Ca	Not rated	4.61	Not rated	BB+/Ba1	566,707
Cum. yield change	-0.84	-0.87	0.48	-1.71	0.56	566,707

TABLE 2. Descriptive statistics for the treatment and control bonds

Note: This table reports the descriptive statistics for the key variables of the eligible bonds and for the control groups for the period between January 2016 and September 2017. The first control group considers all non-eligible bonds. The second considers bonds that meet all eligibility criteria except for the credit rating.

Table 2 reports the descriptive statistics for the eligible bonds and for the two control groups used in the analysis. The yields on eligible bonds are, as expected, significantly lower than those of the bonds in the control groups. They are also less volatile. The higher creditworthiness of eligible bonds is also visible in their average rating. Actually, the median non-eligible bond does not have a rating. Eligible bonds also show longer average maturities. When we examine the cumulative change in bond yields since the announcement of the programme until September 2017, we find that the absolute decline in bond yields for eligible bonds was smaller than for bonds in the control groups. On average, eligible bonds showed a decrease in bond yields of 43 bps, which compares to an average decline of 75 bps for all the other bonds for which we have collected data. In the stricter control group, where we consider bonds that meet all the criteria except for the rating, bond yields decreased 84 bps. While the absolute decline was larger for non-eligible bonds, we should also note that these bonds have higher yields, on average. When we consider the relative change, we actually find that the yield on eligible bonds decreased 35.2%, compared to 35.1% in the broader control group and 32.6% in the stricter.

Figures 3 and 4 confirm that, in our sample, the indirect effects might have dominated the direct effects. The two figures show the change relative to the announcement date for a long window, starting 49 days before the announcement and going up to September 2017. Figure 3 shows the results for the broader control group, while Figure 4 considers the stricter control group. The main conclusion is the same: yields decreased more

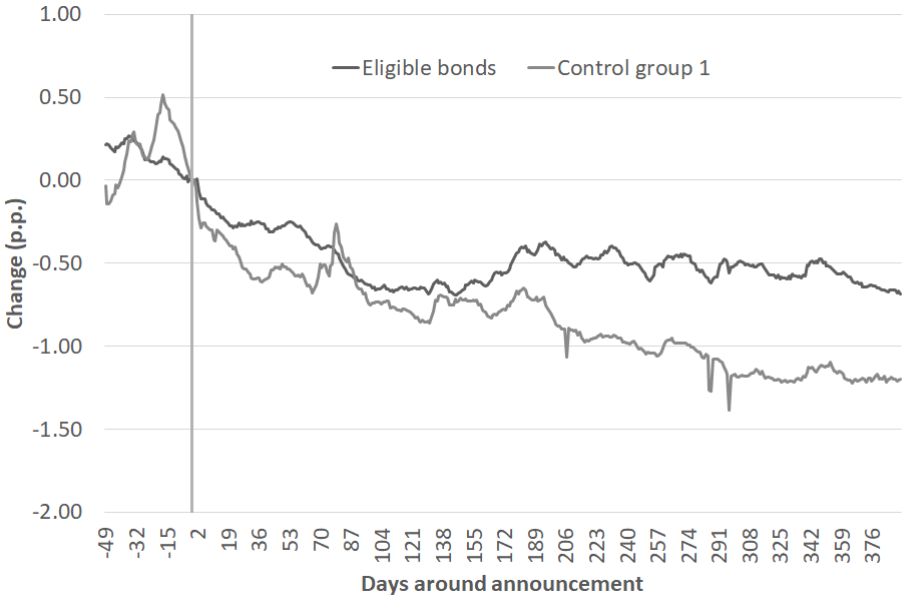

FIGURE 3: Change in bond yields

Note: Control group 1 refers to all non-eligible bonds in the sample.

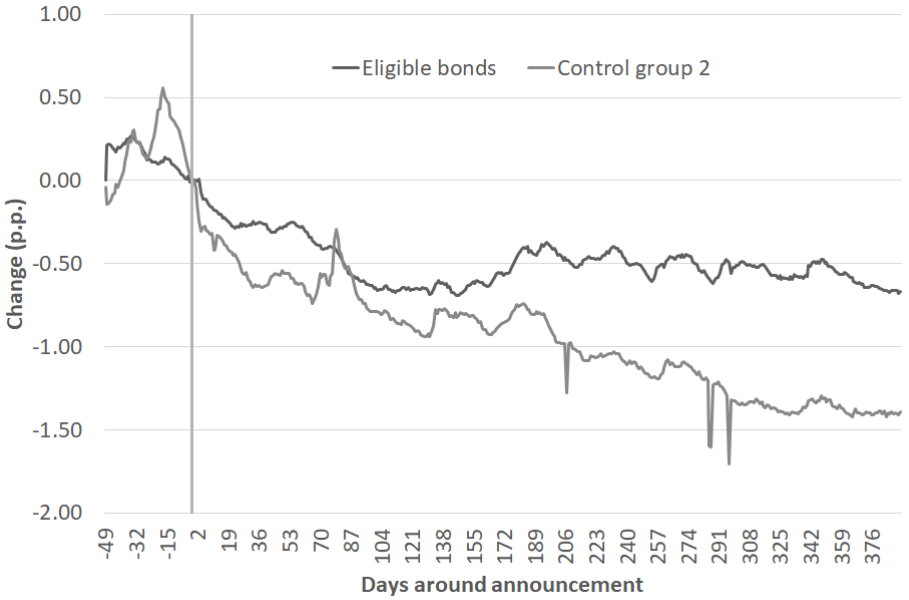

FIGURE 4: Change in bond yields

Note: Control group 2 refers to bonds that meet all the eligibility criteria except for the rating.

significantly for the bonds that are not eligible than for those that actually could be purchased by the Eurosystem. The effect is slightly more pronounced in the stricter control group.

The effect is visible immediately after the announcement and lasts until the end of the sample period. That said, it is important to mention that before the announcement of the CSPP programme, the bonds in the control group had shown a spike that was reversed in the days preceding the announcement.[8] This compromises the parallel trends assumption that is required for precise identification of treatment effects.

The change in bond yields was larger for the non-eligible bonds both immediately after the announcement as well as by the end of the sample period (September 2017). However, there is a period in between during which this difference is diluted. This happens roughly 60 trading days after the announcement and persists for a bit more than two weeks. This coincides with the effective start date of the programme. From June 8 onward, we see a steeper decline of bond yields that are eligible for the programme and, conversely, an increase of bond yields in the control group. This lasts until the end of June. This shows that once the Eurosystem starts purchasing bonds, the direct effect of programme dominates the indirect one, as the eligible bonds are the ones for which there are larger decrease in yields. However, that effect is not long-lasting and soon market participants begin to show again increased demand for non-eligible bonds.

It is also possible that this temporary change immediately after the purchases start reflects unmet demand of high quality corporate securities. Even though the programme was designed in a way that limited the purchases done by the Eurosystem so as to not affect market developments and ensure enough liquidity, the smaller scale and depth of the European corporate debt market might have challenged the stability of prices during a short period. Precisely to avoid the lack of high quality corporate bonds in the market, on July 18, 2016, the ECB added corporate bonds purchased through the CSPP to the securities lending initiative.[9]

5. Regression analysis

Using a difference-in-differences approach, we are able to provide further insights on the relative performance of eligible and non-eligible bonds after the announcement of the CSPP programme in March 2016. Table 3 reports the results of the estimation of equation 1.

8. This behavior could be related to some comments released by the press about which decisions the ECB would announce at its March 10, 2016 meeting, after in January of the same year, at an ECB meeting, Mario Draghi stated that "there are no technical limits" to the measures that could be used. On the days before the announcement date, there were a lot of jitters and presumptions from analyst and market commentators about the options that were on the table for the ECB and this could have been on the origin for the volatility seen in the yield change.

9. Through securities lending, the ECB temporarily transfers securities purchased in the APP to a borrower. In return, that borrower transfers other shares, bonds or cash to the ECB as collateral and pays a borrowing fee. The ECB does securities lending to make sure that financial markets continue to work smoothly, despite the large purchases being made. By lending securities to market participants, potential disruptions are avoided. Further details may be found here: *https* : *//www.ecb.europa.eu/mopo/implement/omt/lending/html/index.en.html*

Dependent variable: yield

	All bonds, full period				All bonds, [-30, 30]				Exclude non-rated, [-30, 30]				All bonds, without controls, [-30, 30]			
	Control group 1		Control group 2		Control group 1		Control group 2		Control group 1		Control group 2		Control group 1		Control group 2	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Eligible*Post	0.59	***	0.60	***	0.20	***	0.25	***	0.62	***	0.79	***	0.21	***	0.25	***
	(16.08)		*(9.72)*		*(4.85)*		*(5.95)*		*(8.53)*		*(9.92)*		*(4.81)*		*(5.88)*	
Eligible	-2.00	***	-3.38	***	-2.51	***	-4.24	***	-1.14	***	-2.35	***	-2.84	***	-3.18	***
	-(15.98)		*-(20.25)*		*-(13.53)*		*-(19.66)*		*-(8.18)*		*-(12.12)*		*-(28.75)*		*-(30.73)*	
Post	-1.08	***	-1.09	***	-0.47	***	-0.51	***	-0.90	***	-1.06	***	-0.47	***	-0.52	***
	-(18.99)		*-(18.60)*		*-(11.79)*		*-(12.60)*		*-(12.65)*		*-(13.55)*		*-(11.74)*		*-(12.63)*	
Rating	-0.06	***	0.02		-0.03	**	0.08	***	-0.50	***	-0.40	***	-		-	
	-(7.54)		*(1.47)*		*-(2.24)*		*(4.98)*		*-(27.09)*		*-(18.34)*		-		-	
Tenor	0.0001	***	0.0003	***	0.0001	***	0.0003	***	0.0002	***	0.0004	***	-		-	
	(8.96)		*(13.79)*		*(5.95)*		*(9.82)*		*(7.75)*		*(18.38)*		-		-	
Constant	3.01	***	2.84	***	2.84	***	2.60	***	9.58	***	8.75	***	2.99	***	3.12	***
	(16.08)		*(14.30)*		*(13.21)*		*(11.45)*		*(32.01)*		*(30.64)*		*(14.32)*		*(14.31)*	
Country fixed effects	Y		Y		Y		Y		Y		Y		Y		Y	
Observations	1,203,095		1,114,407		155,731		146,795		104,942		99,034		155,731		146,795	

TABLE 3. Regression results for the euro area

Note: The table reports the results of the estimation of equation 1. All regressions include country fixed effects. T-statistics are reported in parenthesis. Columns 1 and 2 report the results for the entire sample period. Columns 3 and 4 report the results using the 30 days before and after the announcement of CSPP. Columns 5 and 6 exclude non-rated bonds from the control group. Columns 7 and 8 estimate the regression without controls. Control group 1 refers to all non-eligible bonds in the sample. Control group 2 includes bonds that meet all the criteria except for the rating. *** significant at 1%, ** significant at 5%, * significant at 10%

In the first column we report the results for the full sample period, using all available bonds in the control group. The results of the estimation confirm the graphical analysis: the yields on eligible bonds decreased less than those of non-eligible bonds after the announcement. After the announcement, the yields on eligible bonds decreased 59 bps less than those of non-eligible bonds, thus confirming that the indirect effects of the programme seem to dominate the direct ones. Even though eligible bonds have lower bond yields and all bonds showed a decrease after the announcement of the programme, this decrease was significantly more pronounced in the non-eligible bonds. This finding is aligned with the results of Abidi and Miquel-Flores (2017) and Gambetti and Musso (2017), who document the presence of the portfolio rebalancing effect and its importance for avoiding market distortions. Investors are pushed to "search for yield" after the CSPP announcement, increasing their demand for riskier, high-yield corporate bonds.[10]

We control for the rating and the maturity of each bond. Bonds with higher ratings have lower yields, which is consistent with the lower risk premia required by market participants on these bonds. Bonds with longer maturities have slightly larger yields, reflecting the positive slope of the yield curve. We also control for country fixed effects.

We consider several alternative specifications to challenge the validity of these results. In column 2 we run the same estimation, but now using the tighter definition of the control group. When we compare eligible bonds to bonds that meet all the necessary criteria except for the rating, we find that the effect is very similar (marginally larger in the tighter control group).

In the two regressions estimated so far we are using a relatively long period after the announcement, including data that goes until the end of September 2017. As shown in Figures 3 and 4, the relative evolution of yields of eligible and non-eligible bonds is not linear throughout the entire sample period. Furthermore, a long estimation window may bias the results due to confounding effects that may differentially affect eligible and non-eligible bonds throughout this period. To avoid these concerns, in columns 3 and 4 we report the results in a shorter time window. We consider the 30 days before and the 30 days after the announcement. In column 3 we consider the broader control group and in column 4 we consider the tighter one.

We find that the magnitude of the effect is smaller, but it goes in the same direction. The larger decrease for non-eligible bonds occurs immediately after the announcement. The larger coefficient for the full sample implies that this immediate effect is magnified as time goes by.

As shown in Tables 1 and 2, there are bonds that do not have ratings. As these bonds may have very different levels of credit risk, they might somehow affect the results. To be sure that is not the case, in columns 5 and 6 we estimate the regressions for the shorter time window of 60 days, for the two control groups, using only rated bonds. The

10. There is another possible explanation for the differences found between the reaction to the announcement of the CSPP of eligible and non-eligible bonds. The latter are typically more volatile, so price reactions may be exacerbated. That said, the differential effect seems to be long-lived and not concentrated only around the announcement date.

differential effect between eligible and non-eligible bonds actually becomes larger in this more comparable sample.

Finally, we estimate equation 1 excluding the variables $Rating$ and $Tenor$ from the regressions. Both variables are part of the eligibility criteria, as only investment grade bonds with a residual maturity of at least 6 months can be part of the programme. To make sure there is no collinearity, in columns 7 and 8 we run the regressions without these controls. The results on the post-announcement effects are broadly unchanged.

Summing up, the results consistently point towards the prevalence of an indirect effect, which may be explained by portfolio rebalancing strategies in a search for yield environment. One important question that remains unanswered is if these effects were visible across the entire euro area or only in some countries.

In Table 4 we report the results for the shorter estimation window for the countries that were more affected by the euro area sovereign debt crisis (Greece, Ireland, Italy, Portugal, and Spain - GIIPS) and the other ones, as these two groups of countries might have been differentially affected by the CSPP (Adelino, Ferreira, Giannetti, and Pires, 2020). The first two columns show the results for the former and the last two for the latter. We report the results for the broader control group in columns 1 and 3, and for the tighter control group in columns 2 and 4.

The results show that portfolio rebalancing was not seen across the entire euro area. Indeed, the indirect effects of the CSPP were only observable in the non-GIIPS countries. In the GIIPS countries, the CSPP lead to a decrease in bonds yields, but eligible and non-eligible bonds were not differentially affected in these countries.

There might also have been heterogeneity within the euro area due to the size (and liquidity) of corporate bond markets in each country. In Table 4 we also report the results for countries with smaller and larger corporate securities markets. We divide euro area countries in these two groups depending on whether non-financial corporate debt securities outstanding as a percentage of GDP where below or above the median when the CSPP was announced.[11]

We find that portfolio rebalancing effects were present in both groups of countries. The larger decline in yields for non-eligible bonds was seen both in countries with smaller and larger corporate debt markets, though the effects were marginally larger for the latter.

11. Countries with smaller corporate securities markets are: Lithuania, Greece, Latvia, Slovenia, Malta Ireland, Germany, Estonia, Slovakia). Countries with larger corporate securities markets are: Cyprus, Italy, Spain, Austria, Netherlands, Belgium, Portugal, Finland, France, Luxembourg).

Dependent variable: yield

	GIIPS All bonds, [-30, 30]				Non-GIIPS All bonds, [-30, 30]				Countries with smaller corporate securities markets All bonds, [-30, 30]				Countries with larger corporate securities markets All bonds, [-30, 30]			
	Control group 1		Control group 2		Control group 1		Control group 2		Control group 1		Control group 2		Control group 1		Control group 2	
	(1)		(2)		(3)		(4)		(5)		(6)		(7)		(8)	
Eligible*Post	0.02		0.08		0.25	***	0.29	***	0.29	***	0.33	***	0.32	***	0.36	***
	(.24)		*(.85)*		*(5.26)*		*(6.23)*		*(4.48)*		*(4.88)*		*(9.60)*		*(10.23)*	
Eligible	-3.02	***	-4.30	***	-2.41	***	-4.23	***	-0.14	***	-0.14	*	-0.18	***	-0.17	***
	-(6.16)		*-(7.57)*		*-(12.06)*		*-(18.29)*		*-(2.61)*		*-(1.95)*		*-(5.47)*		*-(3.87)*	
Post	-0.33	***	-0.38	***	-0.50	***	-0.55	***	-0.53	***	-0.57	***	-0.61	***	-0.66	***
	-(3.56)		*-(4.10)*		*-(11.40)*		*-(12.06)*		*-(8.72)*		*-(8.92)*		*-(19.72)*		*-(19.65)*	
Rating	0.00		0.09	**	-0.04	**	0.07	***	0.00		0.00		0.00		0.00	
	(.06)		*(2.12)*		*-(2.52)*		*(4.51)*		*(.79)*		*(.26)*		*(.86)*		*(.03)*	
Tenor	0.0001	***	0.0002	***	0.0001	***	0.0003	***	0.0000	**	0.0000	**	0.0000	***	0.0000	***
	(3.46)		*(2.67)*		*(5.31)*		*(9.72)*		*-(2.25)*		*-(2.34)*		*-(2.58)*		*-(8.86)*	
Constant	3.99	***	3.91	***	2.86	***	2.61	***	0.20	***	0.25	***	0.29	***	0.34	***
	(14.58)		*(13.39)*		*(13.20)*		*(11.40)*		*(3.63)*		*(4.82)*		*(7.88)*		*(8.93)*	
Country fixed effects	Y		Y		Y		Y		Y		Y		Y		Y	
Observations	28,655		27,344		127,076		119,451		27,481		25,139		125,215		119,213	

TABLE 4. Regression results by country groups

Note: The table reports the results of the estimation of equation 1 for different groups of countries within the euro area. GIIPS are Greece, Italy, Ireland, Portugal and Spain. Columns 1 and 2 report the results for GIIPS and columns 3 and 4 for the remaining euroa area countries. Countries with smaller corporate securities markets are those with corporate debt securities outstanding as a percentage of GDP below the euro area median (Lithuania, Greece, Latvia, Slovenia, Malta Ireland, Germany, Estonia, Slovakia). Countries with larger corporate securities markets are those above the median (Cyprus, Italy, Spain, Austria, Netherlands, Belgium, Portugal, Finland, France, Luxembourg). Control group 1 refers to all non-eligible bonds in the sample. Control group 2 includes bonds that meet all the criteria except for the rating. All regressions include country fixed effects. *** significant at 1%, ** significant at 5%, * significant at 10%

For robustness purposes, we run an additional exercise at the euro area level. Instead of considering the level of bond yields as the dependent variable, we consider the change in bond yields. This allows to consider the magnitude of the change and not only the direction of the change in yields. In Table 5 we report the same set of specifications reported in Tables 3 and 4, but now using the change in yields as the dependent variable. For brevity, we report only the results using the tighter control group.

In all the specifications we obtain a positive coefficient on the interaction effect, as in Table 3. This result confirms that the yields on non-eligible bonds decreased more and faster than those of eligible bonds.

These results are broadly in line with those obtained by Abidi and Miquel-Flores (2017), who find that the impact on yields of non-eligible bonds is also greater than eligible bonds, thus meaning that the indirect effect of the CSPP dominates the direct one. This is consistent with portfolio rebalancing strategies, as the purchases conducted by the Eurosystem create a shortage of supply of some securities, potentially leading to scarcity in the market. This encourages investors to increase the demand for other (non-eligible), increasing their price and compressing their yields. The presence of this rebalancing effect is one of the most important factors in the transmission of quantitative monetary policy (also shown by Altavilla et al., 2015, and Gambetti and Musso, 2017, for the euro area, Joyce et al., 2011, for the UK and D'Amico et al., 2012, for the US). If the corporate purchase programme activity was distorting market functioning, the treatment group should have had a greater impact than the control group. However, according to Boermans and Keshkov (2018), and in line with portfolio rebalancing models, a distortion occurs when there is an impact on the dispersion of bond ownership with groups of investors being displaced asymmetrically due to the activity carried out by the central regulator.

Dependent variable: change in yields

	All bonds, full period (1)		All bonds, [-30, 30] (2)		Exclude non-rated, [-30, 30] (3)		All bonds, without controls, [-30, 30] (4)		All bonds, [-30, 30], GIIPS (5)		All bonds, non-GIIPS (6)	
Eligible*Post	0.52	***	0.36	***	1.06	***	0.36	***	0.20	***	0.40	***
	(7.49)		*(11.29)*		*(18.37)*		*(11.28)*		*(2.80)*		*(11.16)*	
Eligible	0.70	***	-0.17	***	-0.58	***	-0.17	***	-0.08		-0.19	***
	(7.85)		*-(4.36)*		*-(13.33)*		*-(8.43)*		*-(.98)*		*-(4.33)*	
Post	-1.15	***	-0.64	***	-1.34	***	-0.64	***	-0.52	***	-0.67	***
	-(24.32)		*-(21.57)*		*-(23.71)*		*-(21.55)*		*-(8.19)*		*-(20.02)*	
Rating	-0.06	***	0.00		0.01	***	-		0.00		0.00	
	-(9.10)		*(.18)*		*(3.77)*		-		*-(.10)*		*(.23)*	
Tenor	0.0000	**	0.0000	***	0.0000	***	-		0.0000	***	0.0000	***
	(2.30)		*-(9.01)*		*-(8.11)*		-		*-(3.13)*		*-(8.49)*	
Constant	0.46	***	0.32	***	0.51	***	0.28	***	0.24	***	0.34	***
	(7.49)		*(8.92)*		*(9.09)*		*(8.04)*		*(4.45)*		*(8.96)*	
Country fixed effects	Y		Y		Y		Y		Y		Y	
Observations	923,570		144,352		97,458		144,352		26,964		117,388	

TABLE 5. Regression results - change in yields

Note: The table reports the results of the estimation of equation 1, but considering as dependent variable the change in yields. All regressions include country fixed effects. Column 1 reports the results for the entire sample period. Column 2 reports the results using the 30 days before and after the announcement of CSPP. Column 3 excludes non-rated bonds from the control group. Column 4 estimates the regression without controls. Column 5 reports the estimates for the GIIPS countries and column 6 for the remaining countries. All the results refer to the second control group, which includes bonds that meet all the criteria except for the rating. *** significant at 1%, ** significant at 5%, * significant at 10%

6. The effects of the announcement of the CSPP in Portugal

While other authors have looked into announcement effects at the euro area level, there is no specific analysis on the effects on the Portuguese corporate debt market. In this section we replicate the analysis implemented in the previous one, but comparing only eligible versus non-eligible Portuguese bonds.

For the period under analysis (January 2016 to September 2017), only three corporations have bonds that are CSPP-eligible: Brisa, Energias de Portugal (EDP) and Redes Energéticas Nacionais (REN). Figure 1 shows the net issuance of Portuguese bonds. There was a small increase in 2017, which might have reflected the incentives provided by the CSPP, but it was apparently short-lived. During the sample period there were no new Portuguese CSPP-eligible issuers.[12]

Figure 5 shows the change of bond yields in the Portuguese corporate debt market after the annoucement of the CSPP programme. In this case, the situation is very different from that seen in the euro area. There was a steep decrease in the yields of eligible bonds, while the yield on other bonds remained broadly unchanged in the months following the announcement of the program. Figure 5 reports the results for the tighter control group, but they look similar when all non-eligible bonds are considered.

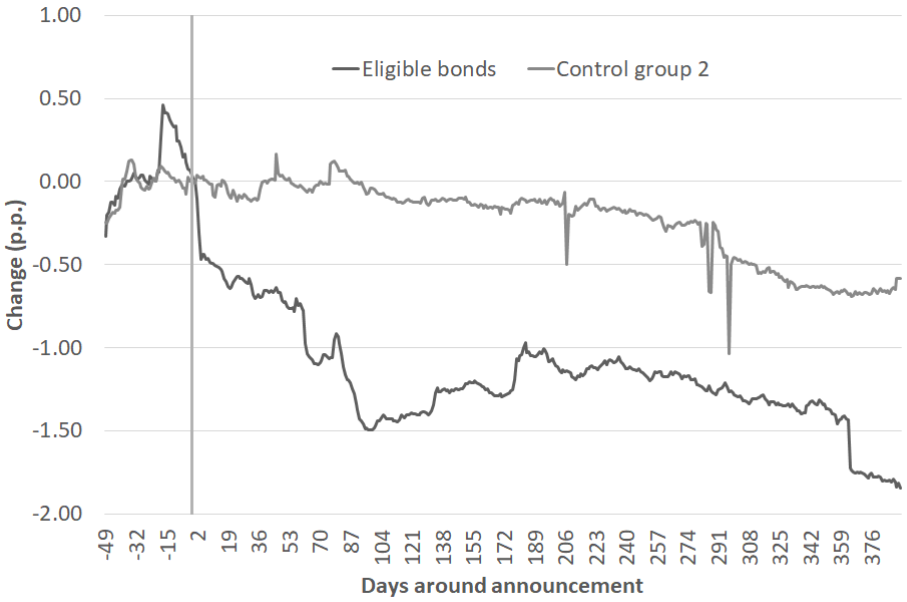

FIGURE 5: Change in bond yields in the Portuguese corporate debt market
Note: Control group 2 refers to bonds that meet all the eligibility criteria except for the rating.

In Table 6 we report summary statistics for Portuguese corporate bonds. Comparing the values for the entire sample of Portuguese bonds with those of the euro area, we find that Portuguese issues have, on average, higher yields, shorter maturities and lower

12. In 2018, Metropolitano de Lisboa and Nos SGPS also had eligible securities.

credit ratings. These differences also hold for the sub-sample of eligible bonds. However, when we compare the control groups, we find that the average bond yields of non-eligible bonds are smaller in Portugal than in the euro area. There is also less dispersion in Portuguese non-eligible bonds. This suggests that the non-eligible Portuguese bonds may be less risky than the euro area average, while the opposite holds for eligible firms. Another important difference, already illustrated in Figure 5, is that the drop in yields was larger for eligible than for non-eligible firms, unlike what was seen in the euro area.

All bonds						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	2.52	2.20	1.98	-0.83	16.50	27,590
Tenor	1,828	1,243	2,757	0	21,805	27,590
Credit rating	C/C	Not rated	CCC/Caa2	Not rated	BBB/Baa2	27,590

Eligible bonds						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	1.08	1.22	0.82	-0.23	3.90	3,134
Tenor	1,635	1,697	1,005	183	3,657	3,134
Credit rating	BBB/Baa2	BBB/Baa2	Not rated	BBB-/Baa3	BBB/Baa2	3,134
Cum. yield change	-1.07	-1.19	0.47	-1.84	0.46	3,134

Control group 1 (all non-eligible bonds)						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	2.70	2.42	2.01	-0.83	16.50	24,456
Tenor	1,853	1,204	2,906	0	21,805	24,456
Credit rating	D/C	Not rated	CC/Ca	Not rated	BBB/Baa2	24,456
Cum. yield change	-0.24	-0.20	0.20	-0.86	0.15	24,456

Control group 2 (bonds that meet all criteria except rating)						
Variable	Mean	Median	Std. Dev.	Min	Max	Observations
Yield	2.57	2.34	1.84	-0.40	16.50	22,269
Tenor	1,595	1,263	1,150	183	5,306	22,269
Credit rating	Not rated	Not rated	C/Ca	Not rated	BB+/Ba1	22,269
Cum. yield change	-0.26	-0.14	0.23	-1.03	0.17	22,269

TABLE 6. Descriptive statistics for the treatment and control bonds

Note: This table reports the descriptive statistics for the key variables of Portuguese corporate bonds for the period between January 2016 and September 2017. The first control group considers all non-eligible bonds. The second considers bonds that meet all eligibility criteria except for the credit rating.

We estimate the same regressions as in the previous section for the Portuguese corporate bond market. The results are reported in Table 7. In the first four columns we report the results using the bond yields as dependent variables (as in Table 3) and in the last four we use the cumulative change in bond yields (as in Table 5). For each dependent variable, we first consider the full period for the estimation (columns 1, 2, 5, and 6) and afterwards we focus on the shorter window around the announcement date (columns 3, 4, 7 and 8).

	Dependent variable: yield								Dependent variable: change in yields							
	All bonds, full period				All bonds, [-30, 30]				All bonds, full period				All bonds, [-30, 30]			
	Control group 1 (1)		Control group 2 (2)		Control group 1 (3)		Control group 2 (4)		Control group 1 (5)		Control group 2 (6)		Control group 1 (7)		Control group 2 (8)	
Eligible*Post	0.41		0.02		0.02		-0.14		-0.94	***	-1.02	***	-0.58	***	-0.60	***
	(.87)		*(.05)*		*(.06)*		*-(.48)*		*-(3.70)*		*-(4.10)*		*-(3.10)*		*-(3.17)*	
Eligible	-0.99		-2.06	***	-1.80	**	-2.02	***	0.02		-0.19		-0.01		-0.08	
	-(1.30)		*-(3.12)*		*-(2.28)*		*-(2.58)*		*(.08)*		*-(.81)*		*-(.08)*		*-(.41)*	
Post	-0.82	**	-0.56		-0.42	**	-0.29	*	-0.26		-0.19		-0.06		-0.04	
	-(2.54)		*-(1.58)*		*-(2.39)*		*-(1.67)*		*-(1.48)*		*-(1.17)*		*-(.59)*		*-(.37)*	
Rating	-0.07		0.04		0.00		0.03		0.00		0.02		0.01		0.02	
	-(1.34)		*(.90)*		*-(.07)*		*(.67)*		*-(.11)*		*(1.51)*		*(.96)*		*(1.49)*	
Tenor	0.0002	**	0.0004	**	0.0002	***	0.0003		-0.0001	***	0.0000		0.0000	***	0.0000	
	(2.54)		*(2.19)*		*(2.60)*		*(1.04)*		*-(4.71)*		*-(.15)*		*-(3.65)*		*-(.78)*	
Constant	3.21	***	2.35	***	3.14	***	2.68	***	0.19		-0.02		0.08		0.03	
	(8.00)		*(4.53)*		*(6.97)*		*(3.83)*		*(1.62)*		*-(.10)*		*(.86)*		*(.23)*	
Country fixed effects	N		N		N		N		N		N		N		N	
Observations	27,590		25,403		3,320		3,092		22,453		20,419		3,215		3,011	

TABLE 7. Regression results for Portugal

Note: The table reports the results of the estimation of equation 1 for Portuguese bonds. The regressions do not include country fixed effects. Columns 1 to 4 show the results when the dependent variable is the yield and columns 5 to 8 show the results for the cumulative change in yields. Columns 1-2 and 5-6 show the results for the full sample period and columns 3-4 and 7-8 show the results for a 60 days window centered on the announcement day. Columns 1, 3, 5, and 7 show the results for the broad control group and the remaining columns show the results for the tighter control group. *** significant at 1%, ** significant at 5%, * significant at 10%

The results are indeed very different from those observed for the entire euro area, in line with what was suggested by the descriptive analysis of the data. When we consider the effect on bond yields (columns 1 to 4), we find that even though there was a decline in bond yields, the eligible bonds were not differentially affected. In other words, the decrease in the yields of eligible bonds was not statistically different from that seen for the other Portuguese bonds.

When we consider the effect on the cumulative change in bond yields (columns 5 to 8), we find that the decrease in bond yields was actually larger for eligible than for non-eligible bonds after the announcement of the CSPP. The effect is stronger when we consider the tighter control group, which includes bonds that meet all the eligibility criteria except for the rating. This means that the direct effect is stronger than the indirect one. This goes in line with the finding that the results regarding the indirect effects are dominant only in the non-GIIPS countries (Table 4). In Portugal, a country that was in the eye of the storm during the euro area sovereign debt crisis, the indirect effects are not visible.

7. Conclusion

Through an extensive granular data collection, particularly at the credit rating level, our study provides new insights regarding the impact of the CSPP announcement. The analysis conducted confirms previous evidence of a general decrease in the cost of funding for non-financial corporations in the euro area. This decrease was more pronounced for non-eligible bonds, what is consistent with a portfolio rebalancing effect towards riskier securities. However, this rebalancing was visible only in the non-GIIPS countries of the euro area. Actually, in the Portuguese case we find that the decrease in bond yields was concentrated on the eligible bonds. The results also suggest that securities lending is crucial to avoid bond scarcity and to ensure that there is enough liquidity in the euro area corporate debt market.

Our analysis focuses only on the announcement effects of the CSPP on bond yields. However, the effects of the programme are certainly more general. The incentives for companies to issue more public debt in very advantageous market conditions significantly increased. This should have freed banks' resources, making them more willing to finance companies without access to bond markets (Arce, Gimeno and Mayordomo, 2017, Grosse-Rueschkamp, Steffen and Streitz, 2019). The generally lower funding costs and improved access to funding should also have contributed to positive real outcomes, for instance in terms of corporate investment and job creation.

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